Seattle EnvStd Training

November 4, 2002. 8 am to 12 pm

Seattle EnvStd Training Agenda (11/4/2002, 8:00 am – 12:00 pm)

Time	Topic	Presenter	Duration	
8:00 AM	Welcome	John Hogan	15	
8:15 AM	Underlying Concepts and Algorithms	Charles Eley	20	Slides
8:35 AM	Installation and Program Updates	Tianzhen Hong	10	
8:45 AM	User Interface Introduction	Charles Eley	25	
9:10 AM	Results and Output Reports	Charles Eley	20	
9:30 AM	Break		20	
9:50 AM	Input Tutorial	Charles Eley	70	
11:00 AM	Class Exercises	Tianzhen Hong	60	
12:00 PM	Wrap-up	Charles Eley John Hogan		

Welcome
- Agenda
- Introduction: Who you are and how you use EnvStd
- Everyone up and running?
- Handouts

Underlying Concepts and Algorithms (slides)
- Calculation Procedures
  - ASHRAE/IESNA Standard 90.1-2001
- Capabilities
- Limitations
- Underlying Criteria
  - Washing State Energy Code
  - Seattle Amendments

Installation and Program Updates
- Install EnvStd Seattle
- Run LiveUpdate

User Interface Introduction
- Interface Components
  - Project Explorer
  - Toolbar
  - Statusbar
  - Menus
  - Editing Forms
    - Building properties
    - Organizers
      - Opaque constructions
      - Fenestrations
    - Opaque construction properties
    - Fenestration properties
    - Space properties
    - Surface properties
    - Opening properties

Results and Output Reports
- View and print reports
  - Project Summary Information
  - Compliance Summary
  - Opaque Constructions Schedule
  - Fenestration Products Schedule
  - Space Category Summary
  - Surfaces
  - Openings

Break

Input Tutorial

Steps

- Start a new project
- Define the building properties
- Create the opaque constructions schedule
- Create the fenestration products schedule
- Add spaces
- Add surfaces
- Add openings

Exercise 1

Create an office building as the baseline
Floor area 150 x 150 x 10 = 225,000 ft^2
WWR of 40% with equally distributed windows on four orientations
Wall: Metal frame with R-13 cavity insulation + R-5 continuous insulation
Roof: Metal deck with R-30
Floor: 8" concrete with R-19 pinned batts
Windows: U-0.45/SHGC-0.40/VT-0.51 (prescriptive path)

Exercise 2

Alternative 1 with WWR of 20% east/west and 60% north/south

Exercise 3

Alternative 2 with WWR of 60% east/west and 20% north/south

Exercise 4

Alternative 3 with windows of U-0.22/SHGC-0.29/VT-0.46 (visionwall: 3 layers)

Exercise 5

Alternative 4 with windows of U-0.16/SHGC/VT (visionwall: 4 layers)

Wrap-up

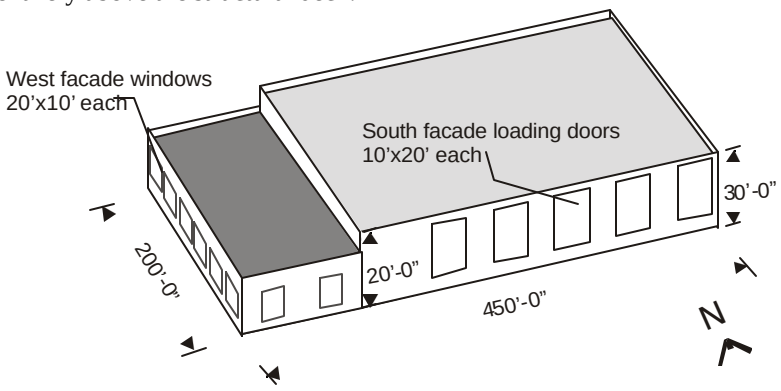
Questions? Wish lists

Tutorial

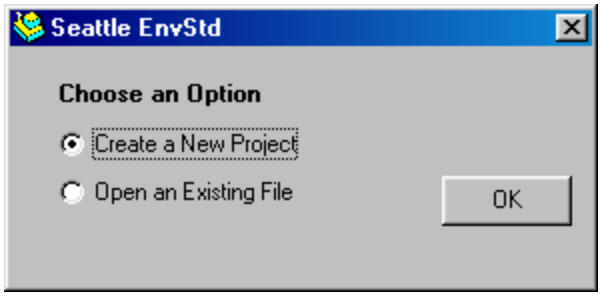
Design is nearing completion on a 90,000 ft^2 single-story building in Seattle. The building is 25% retail showroom and 75% warehouse. The building is 200 ft by 450 ft with the long axis east-west. The showroom is on the west end of the building as shown in the sketch below. The exterior wall height is 20 ft at the showroom and 30 ft at the warehouse. The walls of the warehouse are constructed of solid concrete (tilt-up). In the showroom, the walls have an interior metal furring space with R-11 insulation.

Vertical fenestration is located only in the showroom. The west façade has six windows, each measuring 20 ft wide by 10 ft high for a total of 1,200 ft^2 of fenestration. Both the south and north sides of the show room have two windows also 10x20 ft. The fenestration has an NFRC rated U-factor of 0.45, an SHGC of 0.40 and a light transmission of 0.50.

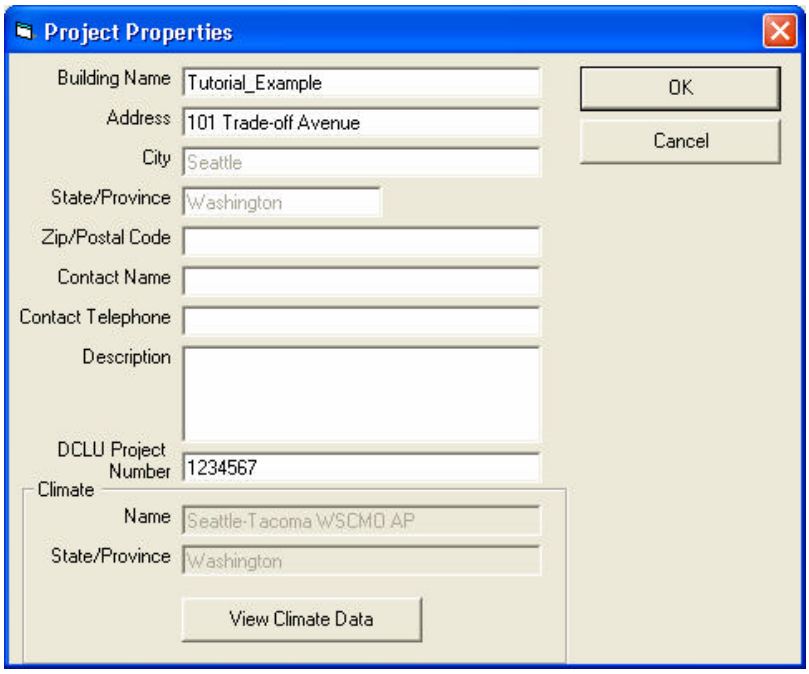
There are five loading doors on the south side of the building. Each is 20 ft wide by 10 ft high and is insulated with an NFRC certified U-factor for the entire door (not just the insulated section) of 0.14. The walls of the building are 8 in. thick concrete, made through the tilt-up construction technique. The walls at the sales area of the building are insulated with R-13 on the inside. The insulation is supported by metal clips installed at 24 in. on center. The concrete walls in the warehouse portion of the building are not insulated. The roof of both the sales area and the warehouse is insulated with R-15 rigid foam installed entirely above the structural deck.



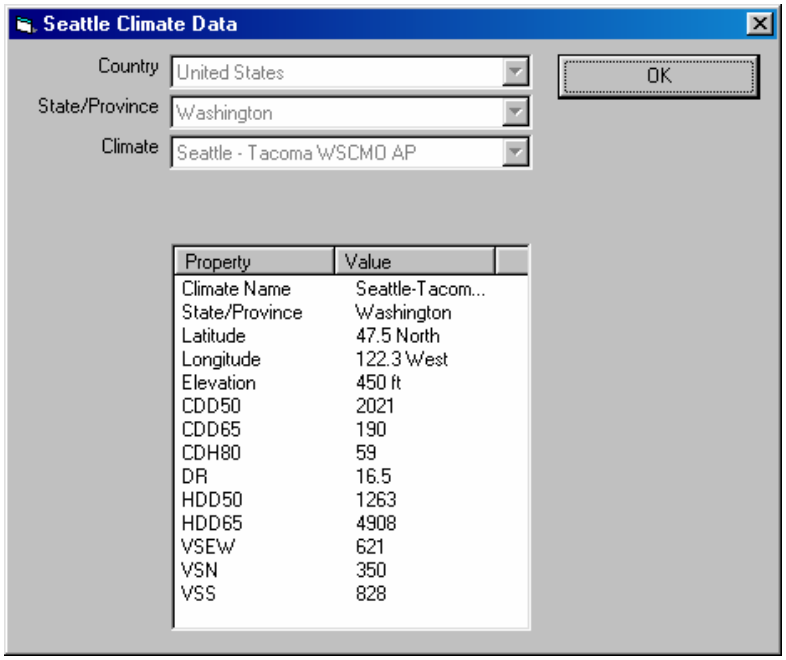
Step 1 – Start the Program. For this example, it is assumed that you have correctly installed the Seattle EnvStd computer program. When you start the program, you are given a choice of starting a new p roject or opening an existing file (see screen below). For this example, choose Create New Project and click the OK button.



Step 2 – Project Properties. The program will then automatically open the Project Properties form where you enter general information about the building for which you are determining compliance. You enter a name for your project, its DCLU address, DCLU project number (a seven-digit number), and an optional description. You also enter the name and telephone number of the person that should be contacted if there are questions about the project or the data that was entered.



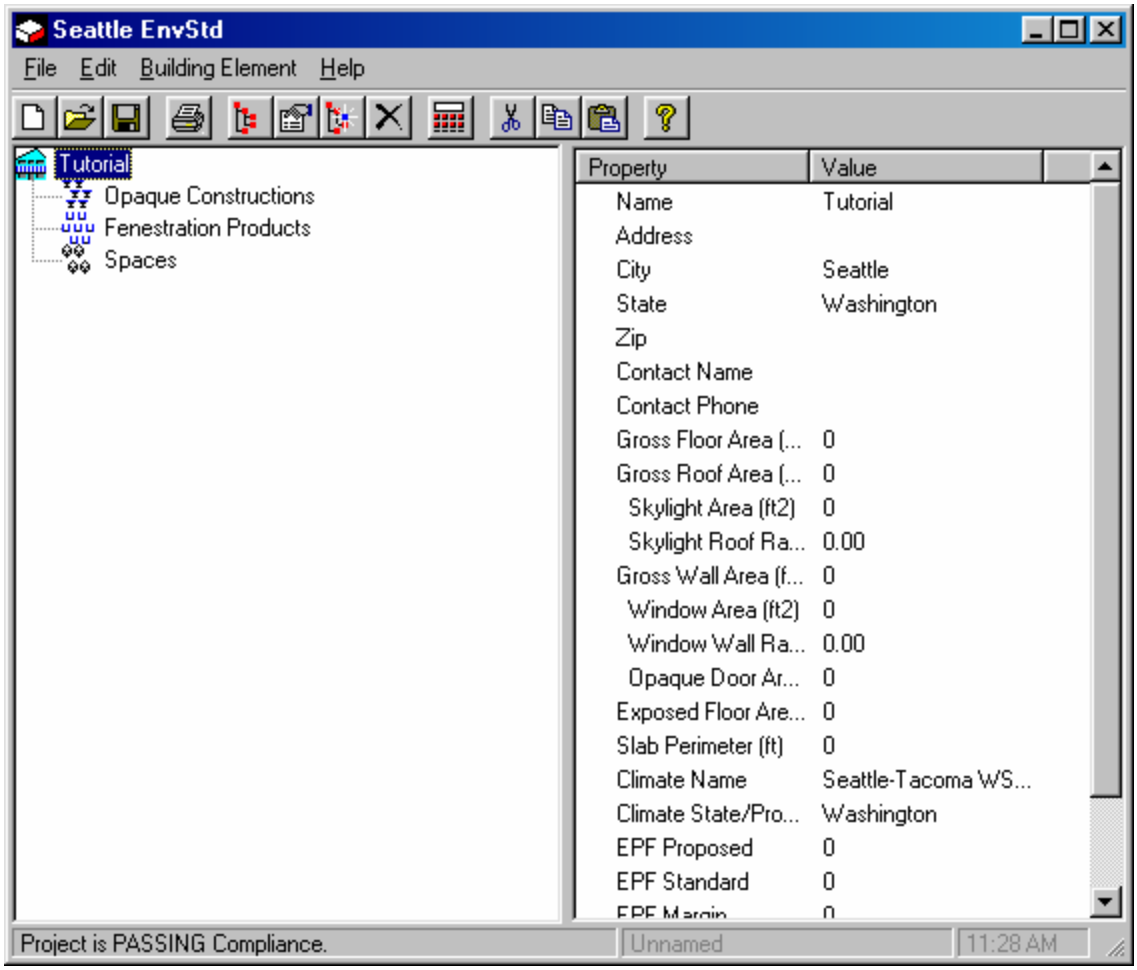
You can click the View Climate Data button to view Seattle climate data used in the code compliance analysis.



The weather variables are displayed in the Property/Value table located on the form.

Step 3 – The Project Explorer. When you click OK to accept the data you entered on the Building Properties form, the form closes and the Project Explorer form appears. This is the main form for the program. The right side of the form shows all the building components in a hierarchical manner. The building object is at the root. When you select an object, the properties of the object are shown in the table on the right. In this case, the building object is selected, and the properties of the building object that you just entered are shown in the table. To edit an object, you first select it and then click the button (Properties) on the tool bar.

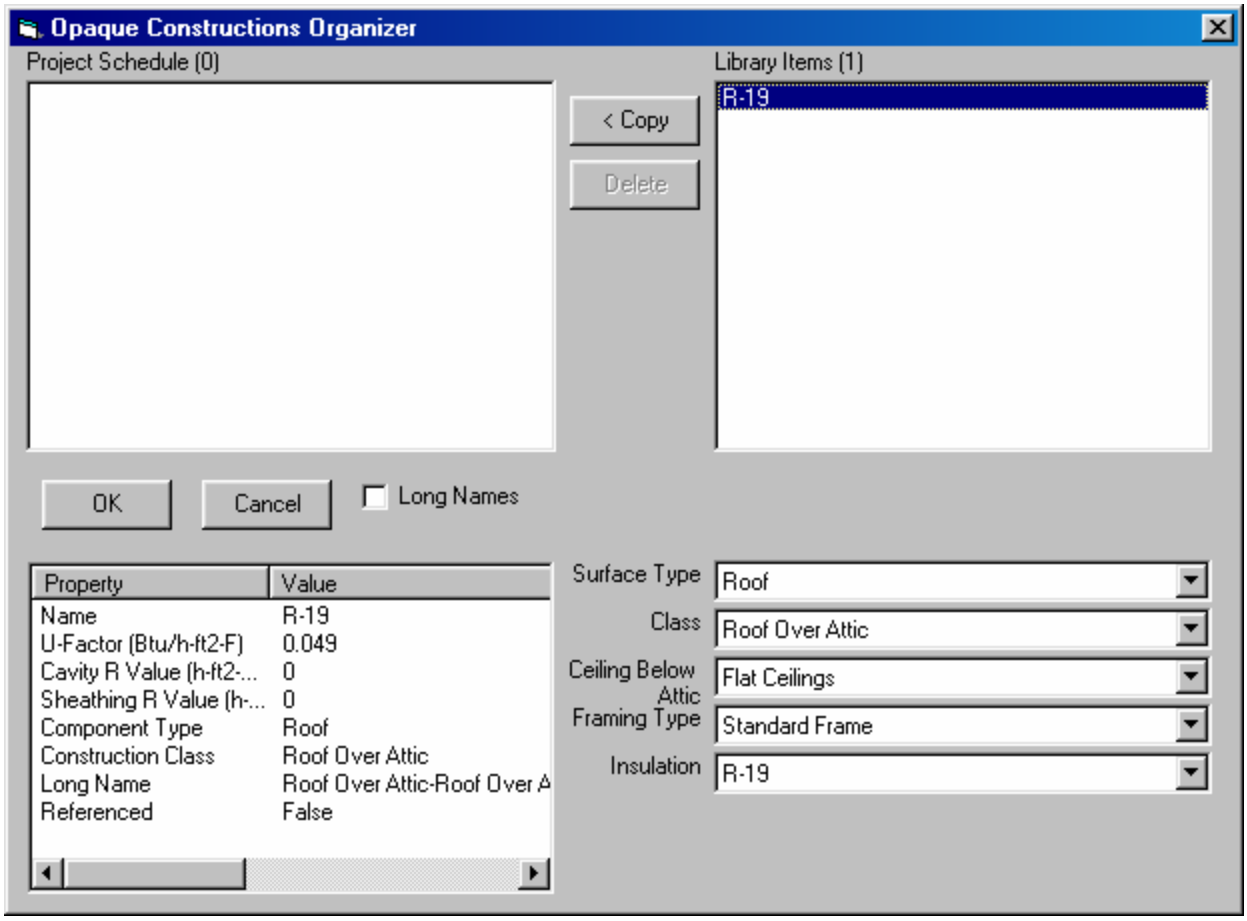
The building object has three child objects: a collection of Opaque Constructions used in the building, a collection of Fenestration Products used in the building, and a collection of Spaces. The first step is to add elements to the collections of Opaque Constructions and Fenestration Products. These collections are the palette of materials that the building is made from.



Step 4 – Create the Opaque Constructions Schedule. You can add to the Opaque Constructions collection in two ways. The easiest method is to use pre-calculated U-factors from Chapter 10 of the Seattle Energy Code. Alternatively, you can enter your own performance data, essentially creating your own opaque construction or fenestration product. However, the Energy Code requires that you use opaque construction data from Chapter 10 of the Seattle Energy Code when reasonable matches exist.

To use the library of constructions from Chapter 10 of the Seattle Energy Code, select the Opaque Constructions node and click the button (Properties) on the tool bar. The following form will appear. All the constructions from the Chapter 10 of the Seattle Energy Code library appear on the right side of the

form. The left side of the form has constructions that have been added to the project schedule. To add a construction from the library to the schedule, select the library construction from the list box on the right of the form labeled “Library” and click the “Copy” command button. This will place a copy of the library opaque construction in the project schedule.

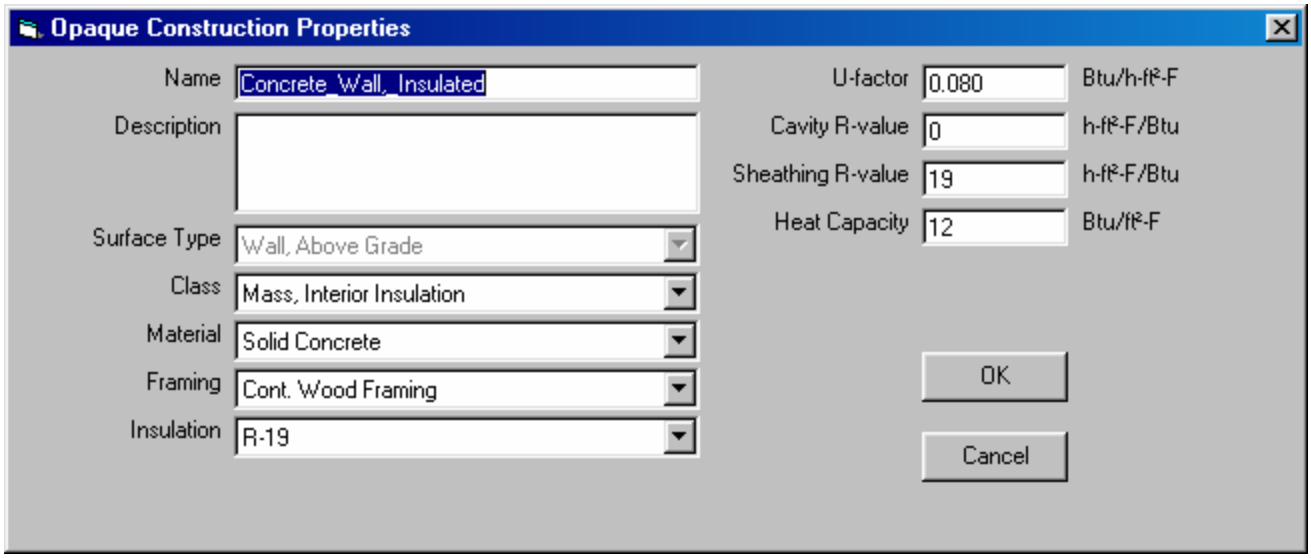


The library of constructions from Chapter 10 of the Seattle Energy Code is quite large with about 1,302 entries. Usually you will want to limit the choices you are viewing. Click the Filter Lists checkbox to view choices for just one component type (roof, wall, etc.) or for just one component class. When you do this, only the “filtered” choices will appear in the Library list box and the Project Schedule list box. Use the drop-down list boxes labeled “Surface Type”, “Class”, etc. to filter the list. Each time you make a choice from these list boxes, the lists will be filtered to show only the choices for that component, class or category.

The construction names are short, and unless you have filtered the list, it may be difficult to tell one construction from another, e.g. several may be called R-11. If you want to see more detail about a construction, click the “Long Names” check box and the names will be displayed with the name of the surface type, the class and other details.

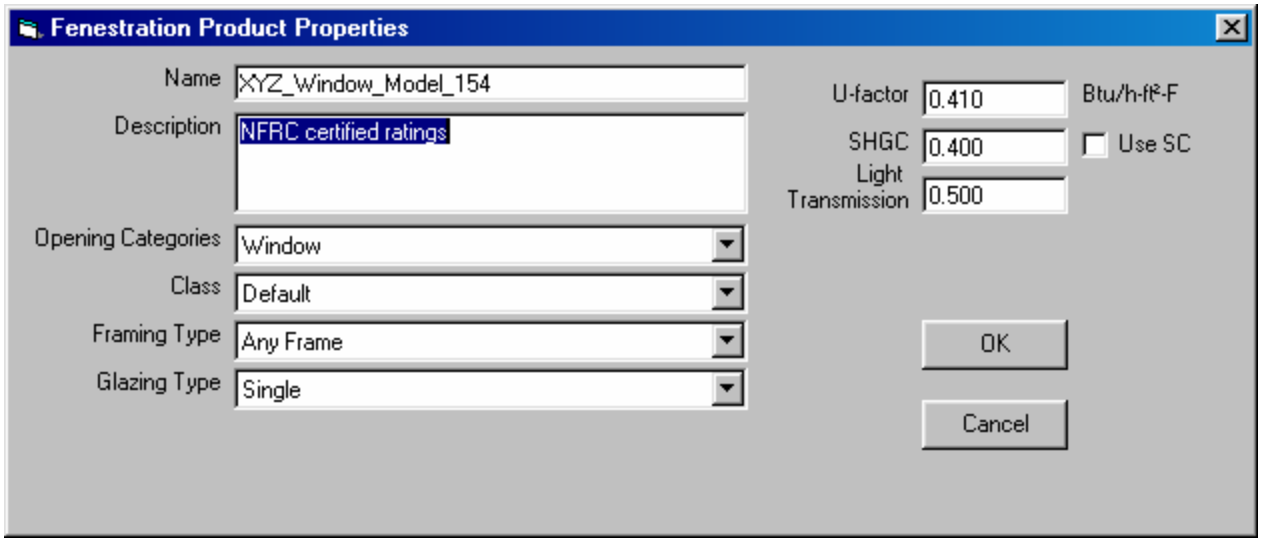
Continue working in the Opaque Constructions organizer until you have comp leted the schedules. For our example building, you need to create a roof construction with R-15 installed entirely over the structural deck, a partially grouted wall construction and a slab construction. The concept of schedules should be familiar to most architects and engineers since the same concept is used to organize construction drawings. If the construction you need is not in the library, then you can enter the data yourself. To do this, choose the Opaque Constructions node on the Project Explorer and click the button (Add Child). A new opaque construction will be created and the following form will appear so that you can define its properties. The

Seattle Energy Code only allows you to enter your own data if Chapter 10 of the Seattle Energy Code does not have a reasonable entry already calculated.

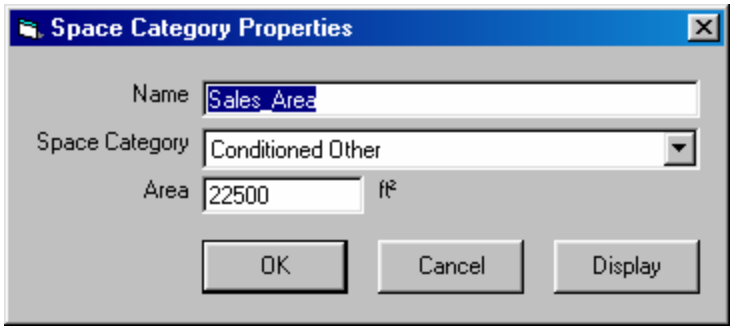


Step 5 – Create the Fenestration Products Schedule. The next step is to add fenestration products to the project schedule. This process is similar to the one used to create the collection of Opaque Constructions, except that the library of constructions is less complete. For fenestration products, the Energy Code requires the use of NFRC (National Fenestration Rating Council) ratings. These data are not included in Chapter 10 of the Seattle Energy Code since the data varies from manufacturer to manufacturer and is ever changing. There are relatively few default U-factors for fenestration. This means that the Fenestration Products library is less important. Most of the time you will need to obtain data from the manufacturer for the specific products you are using in your project.

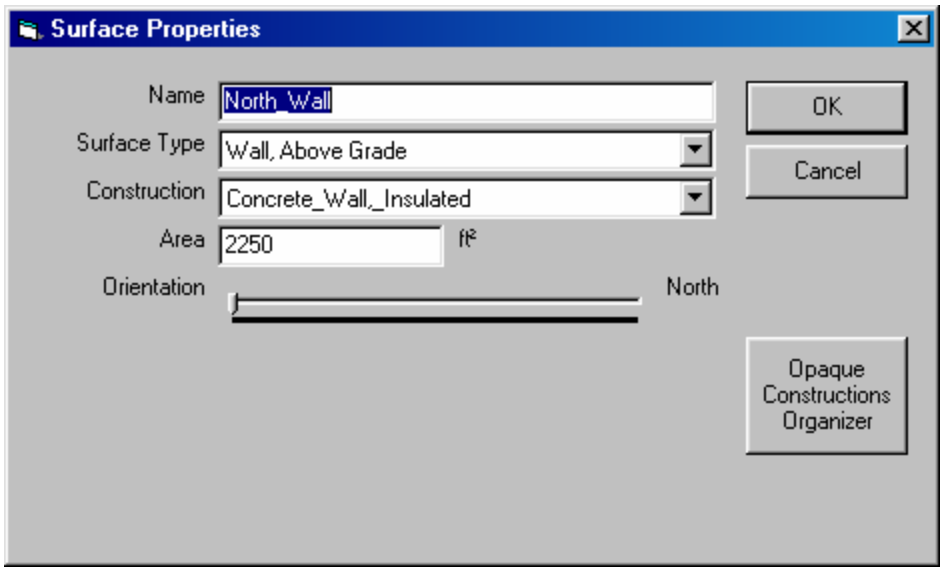
To add a fenestration product, choose the Fenestration Products collection in the Project Explorer and click the button (Add Child). The following form will appear for you to use in defining the properties of the fenestration product. The critical performance characteristics are the U-factor, the light transmission and the solar heat gain coefficient (SHGC). These data are available from NFRC tests.



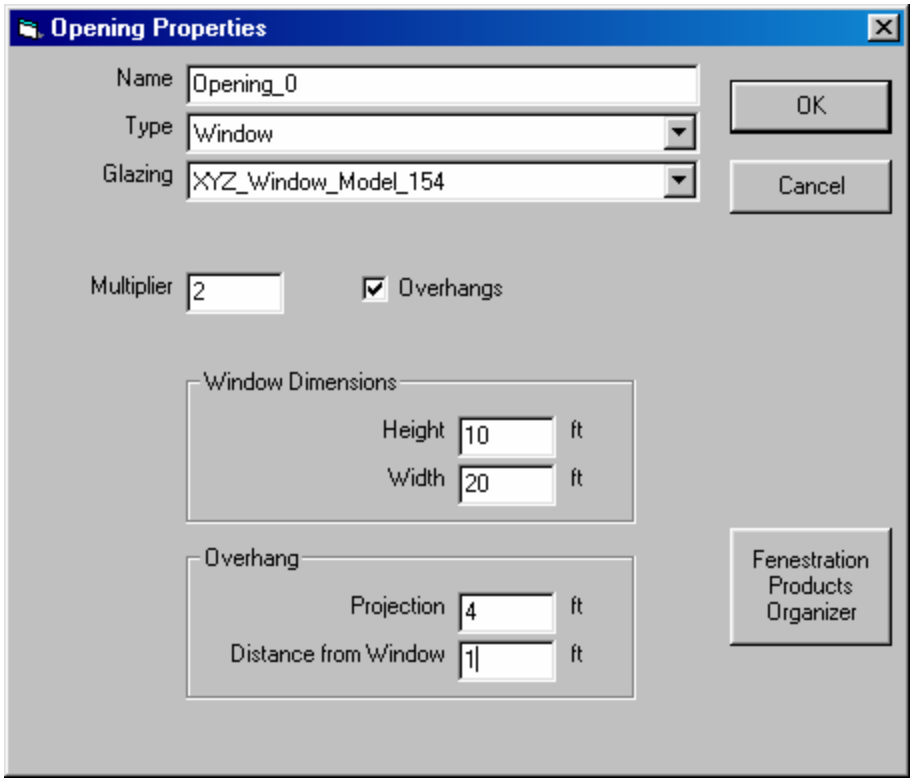
Step 6 – Add the Spaces. Now that the project has a schedule of opaque constructions and fenestration products, you can proceed to enter geometric information about the building. The schedules must be populated before geometric information (surfaces) can be entered. The example building has both conditioned space and semi-heated space. This means that two spaces must be entered. To enter a space, select the Spaces node in the Project Explorer and click the button (Add Child). This action will launch the following form were you enter the properties of the space. Only three properties are applicable: a user defined Name, the space category that must be selected from a drop-down list box (the choices are Conditioned ElecHeat, Conditioned Other, SemiHeated ElecHeat, and SemiHeated Other) and the floor area of the space. For the example building, add to spaces; a Conditioned Others space with 22,500 ft^2 and a semi-heated space of 67,500 ft^2.



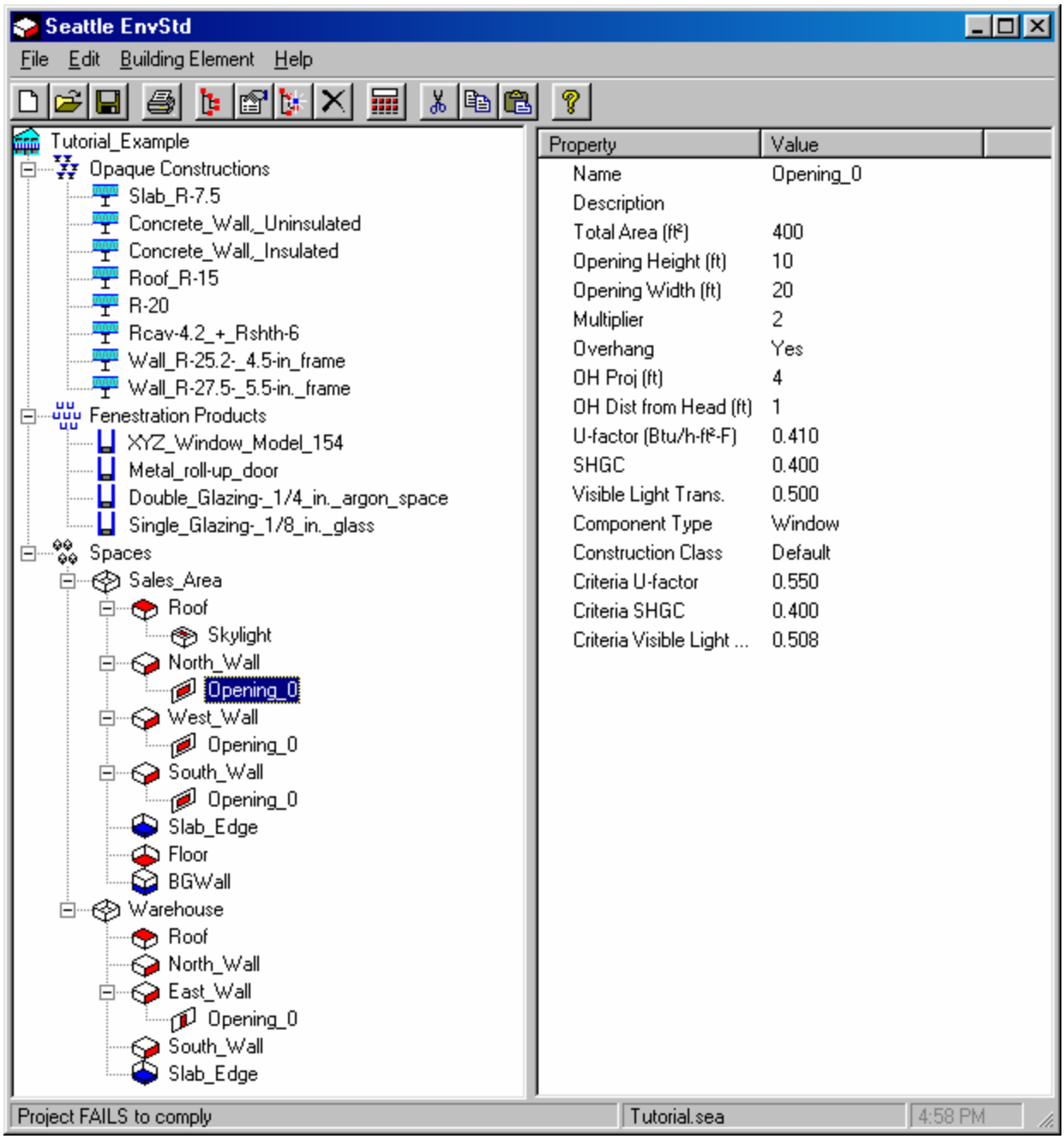
Step 7 – Add Surfaces. Once the spaces have been added to the Project Explorer, the next step is to add the surfaces that surround each of the spaces. In the case of the example building, both the sales and warehouse portion of the building each have one roof, three walls, and a slab. To add a surface, choose the appropriate space and click the button (Add Child). The following form will appear to enable you to define the properties of each of the surfaces. The same form is used for all surfaces, but for walls an additional control appears where you specify the orientation. For walls and roofs, you should enter the gross area (including openings). Choose a construction from the choices in the opaque constructions schedule.



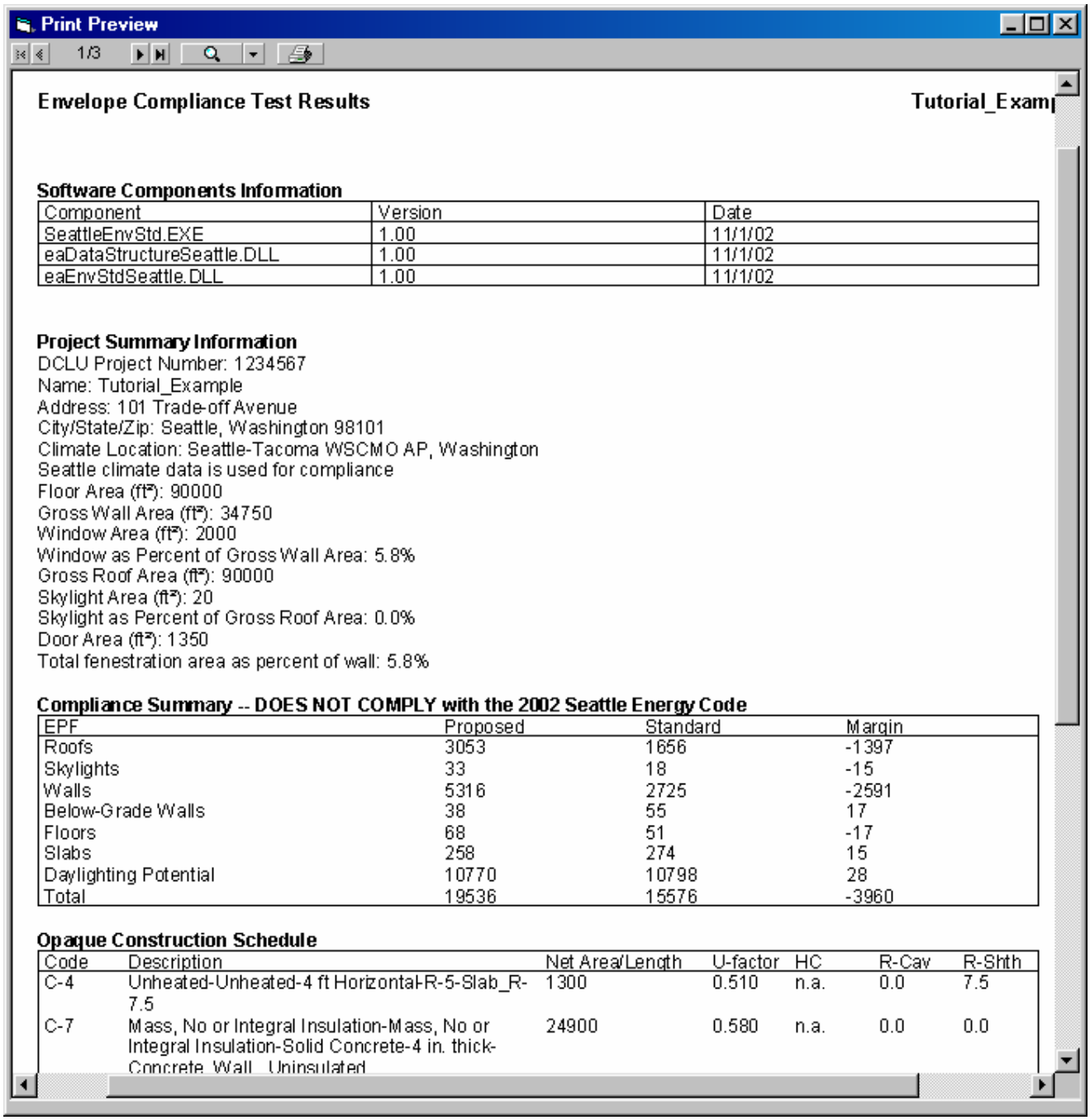
Step 8 – Add Openings. Some of the walls have openings. To add an opening to a wall, select the wall and click the  button (Add Child). This will launch the following form where you define the properties of each of the openings. Repeat this process until each of the openings have been defined.



Step 9 – Project Explorer. Once all the detail has been added to the project, the project explorer should look like the following if all the nodes are expanded. Note that the status bar at the bottom of the form tells you if the project is complying (in this case it is). Each time you add or modify a building envelope component, compliance is recalculated and the status bar is updated.



Step 10 – View/Print Reports. Once you have correctly entered the building you can view and print the compliance reports. To do this, click the button (Print). This will cause the print preview form to appear where you can review the results of the calculation (see below). This report can be printed and attached to your building permit application to demonstrate that the project complies with the building envelope requirements of the 2001 Seattle Energy Code.



Print Preview

1/3

Envelope Compliance Test Results **Tutorial_Exam**

Software Components Information

Component	Version	Date
SeattleEnvStd.EXE	1.00	11/1/02
eaDataStructureSeattle.DLL	1.00	11/1/02
eaEnvStdSeattle.DLL	1.00	11/1/02

Project Summary Information
DCLU Project Number: 1234567
Name: Tutorial_Example
Address: 101 Trade-off Avenue
City/State/Zip: Seattle, Washington 98101
Climate Location: Seattle-Tacoma WSCMO AP, Washington
Seattle climate data is used for compliance
Floor Area (ft²): 90000
Gross Wall Area (ft²): 34750
Window Area (ft²): 2000
Window as Percent of Gross Wall Area: 5.8%
Gross Roof Area (ft²): 90000
Skylight Area (ft²): 20
Skylight as Percent of Gross Roof Area: 0.0%
Door Area (ft²): 1350
Total fenestration area as percent of wall: 5.8%

Compliance Summary -- DOES NOT COMPLY with the 2002 Seattle Energy Code

EPF	Proposed	Standard	Margin
Roofs	3053	1656	-1397
Skylights	33	18	-15
Walls	5316	2725	-2591
Below-Grade Walls	38	55	17
Floors	68	51	-17
Slabs	258	274	15
Daylighting Potential	10770	10798	28
Total	19536	15576	-3960

Opaque Construction Schedule

Code	Description	Net Area/Length	U-factor	HC	R-Cav	R-Shth
C-4	Unheated-Unheated-4 ft Horizontal-R-5-Slab_R-7.5	1300	0.510	n.a.	0.0	7.5
C-7	Mass, No or Integral Insulation-Mass, No or Integral Insulation-Solid Concrete-4 in. thick-Concrete_Wall_Uninsulated	24900	0.580	n.a.	0.0	0.0

Criteria

	Conditioned ElecHeat	Conditioned Other	SemiHeated ElecHeat	SemiHeated Other
CritBin ID	14			
Roof, Over Attic	0.031	0.036	0.031	0.070
Roof, All Others	0.034	0.050	0.034	0.070
Wall, Mass No or Integral Insulation	0.120	0.120	0.120	0.250
Wall, Mass Interior Insulation	0.110	0.110	0.110	0.250
Wall, Mass Exterior Insulation	0.120	0.120	0.120	0.250
Wall, Metal Frame	0.062	0.084	0.062	0.140
Wall, Wood Frame and Other	0.062	0.062	0.062	0.088
Below Grade Walls, No or Integral Insulation	0.070	0.070	0.070	n.a.
Below Grade Walls, Interior Insulation	0.110	0.110	0.110	n.a.
Below Grade Walls, Exterior Insulation	0.070	0.070	0.070	n.a.
Floor	0.029	0.056	0.029	0.088
Slab-on-Grade, Unheated	0.540	0.540	0.540	n.a.
Slab-on-Grade, Heated	0.550	0.550	0.550	n.a.
Opaque Door	0.60	0.60	0.60	n.a.
Vertical Glazing U-factor, WWR <= 10%	0.40	0.55	0.40	0.90
Vertical Glazing U-factor, 10% < WWR <= 20%	0.40	0.55	0.40	n.a.
Vertical Glazing U-factor, 20% < WWR <= 30%	n.a.	0.55	n.a.	n.a.
Vertical Glazing U-factor, 30% < WWR <= 45%	n.a.	0.45	n.a.	n.a.
Overhead Glazing U-factor, WWR <= 10%	0.48	0.66	0.48	0.90
Overhead Glazing U-factor, 10% < WWR <= 20%	0.48	0.66	0.48	n.a.
Overhead Glazing U-factor, 20% < WWR <= 30%	n.a.	0.66	n.a.	n.a.
Overhead Glazing U-factor, 30% < WWR <= 45%	n.a.	0.54	n.a.	n.a.
Glazing SHGC	0.40	0.40	0.40	n.a.

ROOF CLASSES

Roof Over Attic

All Other Roof

CATEGORIES

- Flat Ceilings
  - Standard Frame
    - R-19
    - R-30
    - R-38
    - R-49
    - R-60
  - Advanced Frame
    - R-19
    - R-30
    - R-38
    - R-49
    - R-60
- Scissors Truss
  - Standard Frame
    - R-30 (4/12 roof pitch)
    - R-38 (4/12 roof pitch)
    - R-49 (4/12 roof pitch)
    - R-30 (5/12 roof pitch)
    - R-38 (5/12 roof pitch)
    - R-49 (5/12 roof pitch)
  - Advanced Frame
    - R-30 (4/12 roof pitch)
    - R-38 (4/12 roof pitch)
    - R-49 (4/12 roof pitch)
    - R-30 (5/12 roof pitch)
    - R-38 (5/12 roof pitch)
    - R-49 (5/12 roof pitch)
- Other

- Vaulted Ceilings
  - Vented
    - Standard Frame 16 in. O.C.
      - R-19 2x10 joist
      - R-30 2x12 joist
      - R-38 2x14 joist
    - Advanced Frame 24 in. O.C.
      - R-19 2x10 joist
      - R-30 2x12 joist
      - R-38 2x14 joist
  - Unvented
    - Standard Frame 16 in. O.C.
      - R-30 2x10 joist
      - R-38 2x12 joist
      - R-21 + R-21 2x12 joist
    - Advanced Frame 24 in. O.C.
      - R-30 2x10 joist
      - R-38 2x12 joist
      - R-21 + R-21 2x12 joist
- Roof Deck, 4x Beams 48 in. O.C.
  - R-12.5, 2 in. Rigid insulation
  - R-21.9, 3.5 in. Rigid insulation
  - R-37.5, 6 in. Rigid insulation
  - R-50, 8 in. Rigid insulation
- Steel Truss Framed
  - 12 ft
    - R-19 Cavity + R-0 (none) Sheathing
    - R-19 Cavity + R-3 Sheathing
    - R-19 Cavity + R-5 Sheathing
    - R-19 Cavity + R-10 Sheathing
    - R-19 Cavity + R-15 Sheathing
    - R-30 Cavity + R-0 (none) Sheathing
    - R-30 Cavity + R-3 Sheathing
    - R-30 Cavity + R-5 Sheathing
    - R-30 Cavity + R-10 Sheathing
    - R-30 Cavity + R-15 Sheathing
    - R-38 Cavity + R-0 (none) Sheathing
    - R-38 Cavity + R-3 Sheathing
    - R-38 Cavity + R-5 Sheathing
    - R-38 Cavity + R-10 Sheathing
    - R-38 Cavity + R-15 Sheathing
    - R-49 Cavity + R-0 (none) Sheathing
    - R-49 Cavity + R-3 Sheathing
    - R-49 Cavity + R-5 Sheathing
    - R-49 Cavity + R-10 Sheathing
    - R-49 Cavity + R-15 Sheathing
  - 14 ft
    - R-19 Cavity + R-0 (none) Sheathing
    - R-19 Cavity + R-3 Sheathing
    - R-19 Cavity + R-5 Sheathing
    - R-19 Cavity + R-10 Sheathing
    - R-19 Cavity + R-15 Sheathing
    - R-30 Cavity + R-0 (none) Sheathing
    - R-30 Cavity + R-3 Sheathing
    - R-30 Cavity + R-5 Sheathing
    - R-30 Cavity + R-10 Sheathing
    - R-30 Cavity + R-15 Sheathing
    - R-38 Cavity + R-0 (none) Sheathing
    - R-38 Cavity + R-3 Sheathing
    - R-38 Cavity + R-5 Sheathing
    - R-38 Cavity + R-10 Sheathing
    - R-38 Cavity + R-15 Sheathing
    - R-49 Cavity + R-0 (none) Sheathing
    - R-49 Cavity + R-3 Sheathing
    - R-49 Cavity + R-5 Sheathing
    - R-49 Cavity + R-10 Sheathing
    - R-49 Cavity + R-15 Sheathing
  - 16 ft
    - R-19 Cavity + R-0 (none) Sheathing
    - R-19 Cavity + R-3 Sheathing

R-19 Cavity + R-5 Sheathing
R-19 Cavity + R-10 Sheathing
R-19 Cavity + R-15 Sheathing
R-30 Cavity + R-0 (none) Sheathing
R-30 Cavity + R-3 Sheathing
R-30 Cavity + R-5 Sheathing
R-30 Cavity + R-10 Sheathing
R-30 Cavity + R-15 Sheathing
R-38 Cavity + R-0 (none) Sheathing
R-38 Cavity + R-3 Sheathing
R-38 Cavity + R-5 Sheathing
R-38 Cavity + R-10 Sheathing
R-38 Cavity + R-15 Sheathing
R-49 Cavity + R-0 (none) Sheathing
R-49 Cavity + R-3 Sheathing
R-49 Cavity + R-5 Sheathing
R-49 Cavity + R-10 Sheathing
R-49 Cavity + R-15 Sheathing
18 ft
R-19 Cavity + R-0 (none) Sheathing
R-19 Cavity + R-3 Sheathing
R-19 Cavity + R-5 Sheathing
R-19 Cavity + R-10 Sheathing
R-19 Cavity + R-15 Sheathing
R-30 Cavity + R-0 (none) Sheathing
R-30 Cavity + R-3 Sheathing
R-30 Cavity + R-5 Sheathing
R-30 Cavity + R-10 Sheathing
R-30 Cavity + R-15 Sheathing
R-38 Cavity + R-0 (none) Sheathing
R-38 Cavity + R-3 Sheathing
R-38 Cavity + R-5 Sheathing
R-38 Cavity + R-10 Sheathing
R-38 Cavity + R-15 Sheathing
R-49 Cavity + R-0 (none) Sheathing
R-49 Cavity + R-3 Sheathing
R-49 Cavity + R-5 Sheathing
R-49 Cavity + R-10 Sheathing
R-49 Cavity + R-15 Sheathing
20 ft
R-19 Cavity + R-0 (none) Sheathing
R-19 Cavity + R-3 Sheathing
R-19 Cavity + R-5 Sheathing
R-19 Cavity + R-10 Sheathing
R-19 Cavity + R-15 Sheathing
R-30 Cavity + R-0 (none) Sheathing
R-30 Cavity + R-3 Sheathing
R-30 Cavity + R-5 Sheathing
R-30 Cavity + R-10 Sheathing
R-30 Cavity + R-15 Sheathing
R-38 Cavity + R-0 (none) Sheathing
R-38 Cavity + R-3 Sheathing
R-38 Cavity + R-5 Sheathing
R-38 Cavity + R-10 Sheathing
R-38 Cavity + R-15 Sheathing
R-49 Cavity + R-0 (none) Sheathing
R-49 Cavity + R-3 Sheathing
R-49 Cavity + R-5 Sheathing
R-49 Cavity + R-10 Sheathing
R-49 Cavity + R-15 Sheathing
22 ft
R-19 Cavity + R-0 (none) Sheathing
R-19 Cavity + R-3 Sheathing
R-19 Cavity + R-5 Sheathing
R-19 Cavity + R-10 Sheathing
R-19 Cavity + R-15 Sheathing
R-30 Cavity + R-0 (none) Sheathing
R-30 Cavity + R-3 Sheathing
R-30 Cavity + R-5 Sheathing
R-30 Cavity + R-10 Sheathing
R-30 Cavity + R-15 Sheathing
R-38 Cavity + R-0 (none) Sheathing
R-38 Cavity + R-3 Sheathing
R-38 Cavity + R-5 Sheathing
R-38 Cavity + R-10 Sheathing
R-38 Cavity + R-15 Sheathing
R-49 Cavity + R-0 (none) Sheathing
R-49 Cavity + R-3 Sheathing
R-49 Cavity + R-5 Sheathing
R-49 Cavity + R-10 Sheathing
R-49 Cavity + R-15 Sheathing
24 ft
R-19 Cavity + R-0 (none) Sheathing
R-19 Cavity + R-3 Sheathing
R-19 Cavity + R-5 Sheathing
R-19 Cavity + R-10 Sheathing
R-19 Cavity + R-15 Sheathing
R-30 Cavity + R-0 (none) Sheathing
R-30 Cavity + R-3 Sheathing
R-30 Cavity + R-5 Sheathing
R-30 Cavity + R-10 Sheathing
R-30 Cavity + R-15 Sheathing
R-38 Cavity + R-0 (none) Sheathing
R-38 Cavity + R-3 Sheathing
R-38 Cavity + R-5 Sheathing
R-38 Cavity + R-10 Sheathing
R-38 Cavity + R-15 Sheathing
R-49 Cavity + R-0 (none) Sheathing
R-49 Cavity + R-3 Sheathing
R-49 Cavity + R-5 Sheathing
R-49 Cavity + R-10 Sheathing
R-49 Cavity + R-15 Sheathing
26 ft

R-19 Cavity + R-0 (none) Sheathing
R-19 Cavity + R-3 Sheathing
R-19 Cavity + R-5 Sheathing
R-19 Cavity + R-10 Sheathing
R-19 Cavity + R-15 Sheathing
R-30 Cavity + R-0 (none) Sheathing
R-30 Cavity + R-3 Sheathing
R-30 Cavity + R-5 Sheathing
R-30 Cavity + R-10 Sheathing
R-30 Cavity + R-15 Sheathing
R-38 Cavity + R-0 (none) Sheathing
R-38 Cavity + R-3 Sheathing
R-38 Cavity + R-5 Sheathing
R-38 Cavity + R-10 Sheathing
R-38 Cavity + R-15 Sheathing
R-49 Cavity + R-0 (none) Sheathing
R-49 Cavity + R-3 Sheathing
R-49 Cavity + R-5 Sheathing
R-49 Cavity + R-10 Sheathing
R-49 Cavity + R-15 Sheathing
28 ft
R-19 Cavity + R-0 (none) Sheathing
R-19 Cavity + R-3 Sheathing
R-19 Cavity + R-5 Sheathing
R-19 Cavity + R-10 Sheathing
R-19 Cavity + R-15 Sheathing
R-30 Cavity + R-0 (none) Sheathing
R-30 Cavity + R-3 Sheathing
R-30 Cavity + R-5 Sheathing
R-30 Cavity + R-10 Sheathing
R-30 Cavity + R-15 Sheathing
R-38 Cavity + R-0 (none) Sheathing
R-38 Cavity + R-3 Sheathing
R-38 Cavity + R-5 Sheathing
R-38 Cavity + R-10 Sheathing
R-38 Cavity + R-15 Sheathing
R-49 Cavity + R-0 (none) Sheathing
R-49 Cavity + R-3 Sheathing
R-49 Cavity + R-5 Sheathing
R-49 Cavity + R-10 Sheathing
R-49 Cavity + R-15 Sheathing
30 ft
R-19 Cavity + R-0 (none) Sheathing
R-19 Cavity + R-3 Sheathing
R-19 Cavity + R-5 Sheathing
R-19 Cavity + R-10 Sheathing
R-19 Cavity + R-15 Sheathing
R-30 Cavity + R-0 (none) Sheathing
R-30 Cavity + R-3 Sheathing
R-30 Cavity + R-5 Sheathing
R-30 Cavity + R-10 Sheathing
R-30 Cavity + R-15 Sheathing
R-38 Cavity + R-0 (none) Sheathing
R-38 Cavity + R-3 Sheathing
R-38 Cavity + R-5 Sheathing
R-38 Cavity + R-10 Sheathing
R-38 Cavity + R-15 Sheathing
R-49 Cavity + R-0 (none) Sheathing
R-49 Cavity + R-3 Sheathing
R-49 Cavity + R-5 Sheathing
R-49 Cavity + R-10 Sheathing
R-49 Cavity + R-15 Sheathing
32 ft
R-19 Cavity + R-0 (none) Sheathing
R-19 Cavity + R-3 Sheathing
R-19 Cavity + R-5 Sheathing
R-19 Cavity + R-10 Sheathing
R-19 Cavity + R-15 Sheathing
R-30 Cavity + R-0 (none) Sheathing
R-30 Cavity + R-3 Sheathing
R-30 Cavity + R-5 Sheathing
R-30 Cavity + R-10 Sheathing
R-30 Cavity + R-15 Sheathing
R-38 Cavity + R-0 (none) Sheathing
R-38 Cavity + R-3 Sheathing
R-38 Cavity + R-5 Sheathing
R-38 Cavity + R-10 Sheathing
R-38 Cavity + R-15 Sheathing
R-49 Cavity + R-0 (none) Sheathing
R-49 Cavity + R-3 Sheathing
R-49 Cavity + R-5 Sheathing
R-49 Cavity + R-10 Sheathing
R-49 Cavity + R-15 Sheathing
34 ft
R-19 Cavity + R-0 (none) Sheathing
R-19 Cavity + R-3 Sheathing
R-19 Cavity + R-5 Sheathing
R-19 Cavity + R-10 Sheathing
R-19 Cavity + R-15 Sheathing
R-30 Cavity + R-0 (none) Sheathing
R-30 Cavity + R-3 Sheathing
R-30 Cavity + R-5 Sheathing
R-30 Cavity + R-10 Sheathing
R-30 Cavity + R-15 Sheathing
R-38 Cavity + R-0 (none) Sheathing
R-38 Cavity + R-3 Sheathing
R-38 Cavity + R-5 Sheathing
R-38 Cavity + R-10 Sheathing
R-38 Cavity + R-15 Sheathing
R-49 Cavity + R-0 (none) Sheathing
R-49 Cavity + R-3 Sheathing
R-49 Cavity + R-5 Sheathing
R-49 Cavity + R-10 Sheathing

R-49 Cavity + R-15 Sheathing
36 ft
R-19 Cavity + R-0 (none) Sheathing
R-19 Cavity + R-3 Sheathing
R-19 Cavity + R-5 Sheathing
R-19 Cavity + R-10 Sheathing
R-19 Cavity + R-15 Sheathing
R-30 Cavity + R-0 (none) Sheathing
R-30 Cavity + R-3 Sheathing
R-30 Cavity + R-5 Sheathing
R-30 Cavity + R-10 Sheathing
R-30 Cavity + R-15 Sheathing
R-38 Cavity + R-0 (none) Sheathing
R-38 Cavity + R-3 Sheathing
R-38 Cavity + R-5 Sheathing
R-38 Cavity + R-10 Sheathing
R-38 Cavity + R-15 Sheathing
R-49 Cavity + R-0 (none) Sheathing
R-49 Cavity + R-3 Sheathing
R-49 Cavity + R-5 Sheathing
R-49 Cavity + R-10 Sheathing
R-49 Cavity + R-15 Sheathing
Other

WALL, ABOVE GRADE CLASSES — CATEGORIES

Mass, No or Integral Insulation

Solid Concrete
4 in. thick
5 in. thick
6 in. thick
7 in. thick
8 in. thick
9 in. thick
10 in. thick
11 in. thick
12 in. thick
Conc. Masonry Units
6 in. thick
Solid grouted
Partly grouted, cells empty
Partly grouted, cells insulated
8 in. thick
Solid grouted
Partly grouted, cells empty
Partly grouted, cells insulated
10 in. thick
Solid grouted
Partly grouted, cells empty
Partly grouted, cells insulated
12 in. thick
Solid grouted
Partly grouted, cells empty
Partly grouted, cells insulated
Other

Mass, Interior Insulation

Solid Concrete
Cont. Wood Framing
R-3
R-6
R-10
R-11
R-13
R-15
R-19
R-21
Cont. Metal Framing @ 24 in. o.c. Horiz.
R-3
R-6
R-10
R-11
R-13
R-15
R-19
R-21
1 in. Metal Clips at 24 in. o.c. Horiz. and 16 in. o.c. Vert.
R-3.8, 1 in. frame
R-5, 1 in. frame
R-5.6, 1 in. frame
R-5.7, 1.5 in. frame
R-7.5, 1.5 in. frame
R-8.4, 1.5 in. frame
R-7.6, 2 in. frame
R-10, 2 in. frame
R-11.2, 2 in. frame
R-9.5, 2.5 in. frame
R-12.5, 2.5 in. frame
R-14, 2.5 in. frame
R-11.4, 3 in. frame
R-15, 3 in. frame
R-16.8, 3 in. frame
R-13.3, 3.5 in. frame
R-17.5, 3.5 in. frame
R-19.6, 3.5 in. frame
R-15.2, 4 in. frame
R-20, 4 in. frame
R-22.4, 4 in. frame
R-28, 5 in. frame
Conc. Masonry Units, Solid Grout
Cont. Wood Framing
R-3
R-6
R-10
R-11

R-13
R-15
R-19
R-21
Cont. Metal Framing @ 24 in. o.c. Horiz.
R-3
R-6
R-10
R-11
R-13
R-15
R-19
R-21
1 in. Metal Clips at 24 in. o.c. Horiz. and 16 in. o.c. Vert.
R-3.8, 1 in. frame
R-5, 1 in. frame
R-5.6, 1 in. frame
R-5.7, 1.5 in. frame
R-7.5, 1.5 in. frame
R-8.4, 1.5 in. frame
R-7.6, 2 in. frame
R-10, 2 in. frame
R-11.2, 2 in. frame
R-9.5, 2.5 in. frame
R-12.5, 2.5 in. frame
R-14, 2.5 in. frame
R-11.4, 3 in. frame
R-15, 3 in. frame
R-16.8, 3 in. frame
R-13.3, 3.5 in. frame
R-17.5, 3.5 in. frame
R-19.6, 3.5 in. frame
R-15.2, 4 in. frame
R-20, 4 in. frame
R-22.4, 4 in. frame
R-28, 5 in. frame
Conc. Masonry Units, Partial Grout
Cont. Wood Framing
R-3
R-6
R-10
R-11
R-13
R-15
R-19
R-21
Cont. Metal Framing @ 24 in. o.c. Horiz.
R-3
R-6
R-10
R-11
R-13
R-15
R-19
R-21
1 in. Metal Clips at 24 in. o.c. Horiz. and 16 in. o.c. Vert.
R-3.8, 1 in. frame
R-5, 1 in. frame
R-5.6, 1 in. frame
R-5.7, 1.5 in. frame
R-7.5, 1.5 in. frame
R-8.4, 1.5 in. frame
R-7.6, 2 in. frame
R-10, 2 in. frame
R-11.2, 2 in. frame
R-9.5, 2.5 in. frame
R-12.5, 2.5 in. frame
R-14, 2.5 in. frame
R-11.4, 3 in. frame
R-15, 3 in. frame
R-16.8, 3 in. frame
R-13.3, 3.5 in. frame
R-17.5, 3.5 in. frame
R-19.6, 3.5 in. frame
R-15.2, 4 in. frame
R-20, 4 in. frame
R-22.4, 4 in. frame
R-28, 5 in. frame
Other

Mass, Exterior Insulation

Solid Concrete
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
R-13
R-14
R-15
R-16
R-17
R-18
R-19
R-20
Conc. Masonry Units, Solid Grout
R-3
R-4
R-5

R-6
R-7
R-8
R-9
R-10
R-11
R-12
R-13
R-14
R-15
R-16
R-17
R-18
R-19
R-20
Conc. Masonry Units, Partial Grout
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
R-13
R-14
R-15
R-16
R-17
R-18
R-19
R-20
Other

Metal Framing

Metal Building Walls
Insulation rolled over and perpendicular to structural frame
R-10
R-11
R-13
R-19
Insulation suspended between structural frame
R-10
R-11
R-13
R-19
R-24
R-30
Insulation rolled over structural frame w/rigid insulation blocks
R-10
R-11
R-13
R-19
Insulation suspended between frame w/rigid insulation blocks
R-10
R-11
R-13
R-19
R-24
R-30
Metal Stud Walls
16 in. o.c.
R-11 Cavity + R-0 (none) Sheathing
R-11 Cavity + R-1 Sheathing
R-11 Cavity + R-2 Sheathing
R-11 Cavity + R-3 Sheathing
R-11 Cavity + R-4 Sheathing
R-11 Cavity + R-5 Sheathing
R-11 Cavity + R-6 Sheathing
R-11 Cavity + R-7 Sheathing
R-11 Cavity + R-8 Sheathing
R-11 Cavity + R-9 Sheathing
R-11 Cavity + R-10 Sheathing
R-13 Cavity + R-0 (none) Sheathing
R-13 Cavity + R-1 Sheathing
R-13 Cavity + R-2 Sheathing
R-13 Cavity + R-3 Sheathing
R-13 Cavity + R-4 Sheathing
R-13 Cavity + R-5 Sheathing
R-13 Cavity + R-6 Sheathing
R-13 Cavity + R-7 Sheathing
R-13 Cavity + R-8 Sheathing
R-13 Cavity + R-9 Sheathing
R-13 Cavity + R-10 Sheathing
R-15 Cavity + R-0 (none) Sheathing
R-15 Cavity + R-1 Sheathing
R-15 Cavity + R-2 Sheathing
R-15 Cavity + R-3 Sheathing
R-15 Cavity + R-4 Sheathing
R-15 Cavity + R-5 Sheathing
R-15 Cavity + R-6 Sheathing
R-15 Cavity + R-7 Sheathing
R-15 Cavity + R-8 Sheathing
R-15 Cavity + R-9 Sheathing
R-15 Cavity + R-10 Sheathing
R-19 Cavity + R-0 (none) Sheathing
R-19 Cavity + R-1 Sheathing
R-19 Cavity + R-2 Sheathing
R-19 Cavity + R-3 Sheathing
R-19 Cavity + R-4 Sheathing
R-19 Cavity + R-5 Sheathing
R-19 Cavity + R-6 Sheathing

R-19 Cavity + R-7 Sheathing
R-19 Cavity + R-8 Sheathing
R-19 Cavity + R-9 Sheathing
R-19 Cavity + R-10 Sheathing
R-21 Cavity + R-0 (none) Sheathing
R-21 Cavity + R-1 Sheathing
R-21 Cavity + R-2 Sheathing
R-21 Cavity + R-3 Sheathing
R-21 Cavity + R-4 Sheathing
R-21 Cavity + R-5 Sheathing
R-21 Cavity + R-6 Sheathing
R-21 Cavity + R-7 Sheathing
R-21 Cavity + R-8 Sheathing
R-21 Cavity + R-9 Sheathing
R-21 Cavity + R-10 Sheathing
R-25 Cavity + R-0 (none) Sheathing
R-25 Cavity + R-1 Sheathing
R-25 Cavity + R-2 Sheathing
R-25 Cavity + R-3 Sheathing
R-25 Cavity + R-4 Sheathing
R-25 Cavity + R-5 Sheathing
R-25 Cavity + R-6 Sheathing
R-25 Cavity + R-7 Sheathing
R-25 Cavity + R-8 Sheathing
R-25 Cavity + R-9 Sheathing
R-25 Cavity + R-10 Sheathing
24 in. o.c.
R-11 Cavity + R-0 (none) Sheathing
R-11 Cavity + R-1 Sheathing
R-11 Cavity + R-2 Sheathing
R-11 Cavity + R-3 Sheathing
R-11 Cavity + R-4 Sheathing
R-11 Cavity + R-5 Sheathing
R-11 Cavity + R-6 Sheathing
R-11 Cavity + R-7 Sheathing
R-11 Cavity + R-8 Sheathing
R-11 Cavity + R-9 Sheathing
R-11 Cavity + R-10 Sheathing
R-13 Cavity + R-0 (none) Sheathing
R-13 Cavity + R-1 Sheathing
R-13 Cavity + R-2 Sheathing
R-13 Cavity + R-3 Sheathing
R-13 Cavity + R-4 Sheathing
R-13 Cavity + R-5 Sheathing
R-13 Cavity + R-6 Sheathing
R-13 Cavity + R-7 Sheathing
R-13 Cavity + R-8 Sheathing
R-13 Cavity + R-9 Sheathing
R-13 Cavity + R-10 Sheathing
R-15 Cavity + R-0 (none) Sheathing
R-15 Cavity + R-1 Sheathing
R-15 Cavity + R-2 Sheathing
R-15 Cavity + R-3 Sheathing
R-15 Cavity + R-4 Sheathing
R-15 Cavity + R-5 Sheathing
R-15 Cavity + R-6 Sheathing
R-15 Cavity + R-7 Sheathing
R-15 Cavity + R-8 Sheathing
R-15 Cavity + R-9 Sheathing
R-15 Cavity + R-10 Sheathing
R-19 Cavity + R-0 (none) Sheathing
R-19 Cavity + R-1 Sheathing
R-19 Cavity + R-2 Sheathing
R-19 Cavity + R-3 Sheathing
R-19 Cavity + R-4 Sheathing
R-19 Cavity + R-5 Sheathing
R-19 Cavity + R-6 Sheathing
R-19 Cavity + R-7 Sheathing
R-19 Cavity + R-8 Sheathing
R-19 Cavity + R-9 Sheathing
R-19 Cavity + R-10 Sheathing
R-21 Cavity + R-0 (none) Sheathing
R-21 Cavity + R-1 Sheathing
R-21 Cavity + R-2 Sheathing
R-21 Cavity + R-3 Sheathing
R-21 Cavity + R-4 Sheathing
R-21 Cavity + R-5 Sheathing
R-21 Cavity + R-6 Sheathing
R-21 Cavity + R-7 Sheathing
R-21 Cavity + R-8 Sheathing
R-21 Cavity + R-9 Sheathing
R-21 Cavity + R-10 Sheathing
R-25 Cavity + R-0 (none) Sheathing
R-25 Cavity + R-1 Sheathing
R-25 Cavity + R-2 Sheathing
R-25 Cavity + R-3 Sheathing
R-25 Cavity + R-4 Sheathing
R-25 Cavity + R-5 Sheathing
R-25 Cavity + R-6 Sheathing
R-25 Cavity + R-7 Sheathing
R-25 Cavity + R-8 Sheathing
R-25 Cavity + R-9 Sheathing
R-25 Cavity + R-10 Sheathing
Other

Wood Framed and Others

2 x 4 Single Wood Stud: R-11 Batt
Lapped Wood, STD
R-0 (none)
R-1
R-2
R-3
R-4
R-5

- R-6
- R-7
- R-8
- R-9
- R-10
- R-11
- R-12

- Lapped Wood, ADV
  - R-0 (none)
  - R-1
  - R-2
  - R-3
  - R-4
  - R-5
  - R-6
  - R-7
  - R-8
  - R-9
  - R-10
  - R-11
  - R-12
- T1-11, STD
  - R-0 (none)
  - R-1
  - R-2
  - R-3
  - R-4
  - R-5
  - R-6
  - R-7
  - R-8
  - R-9
  - R-10
  - R-11
  - R-12
- T1-11, ADV
  - R-0 (none)
  - R-1
  - R-2
  - R-3
  - R-4
  - R-5
  - R-6
  - R-7
  - R-8
  - R-9
  - R-10
  - R-11
  - R-12

2 x 4 Single Wood Stud: R-13 Batt

- Lapped Wood, STD
  - R-0 (none)
  - R-1
  - R-2
  - R-3
  - R-4
  - R-5
  - R-6
  - R-7
  - R-8
  - R-9
  - R-10
  - R-11
  - R-12
- Lapped Wood, ADV
  - R-0 (none)
  - R-1
  - R-2
  - R-3
  - R-4
  - R-5
  - R-6
  - R-7
  - R-8
  - R-9
  - R-10
  - R-11
  - R-12
- T1-11, STD
  - R-0 (none)
  - R-1
  - R-2
  - R-3
  - R-4
  - R-5
  - R-6
  - R-7
  - R-8
  - R-9
  - R-10
  - R-11
  - R-12
- T1-11, ADV
  - R-0 (none)
  - R-1
  - R-2
  - R-3
  - R-4
  - R-5
  - R-6
  - R-7
  - R-8
  - R-9

R-10
R-11
R-12
2 x 4 Single Wood Stud: R-15 Batt
Lapped Wood, STD
R-0 (none)
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
Lapped Wood, ADV
R-0 (none)
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
T1-11, STD
R-0 (none)
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
T1-11, ADV
R-0 (none)
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
2 x 6 Single Wood Stud: R-19 Batt
Lapped Wood, STD
R-0 (none)
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
Lapped Wood, INT
R-0 (none)
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
Lapped Wood, ADV
R-0 (none)
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12

T1-11, STD
R-0 (none)
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
T1-11, INT
R-0 (none)
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
T1-11, ADV
R-0 (none)
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
2 x 6 Single Wood Stud: R-21 Batt
Lapped Wood, STD
R-0 (none)
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
Lapped Wood, INT
R-0 (none)
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
Lapped Wood, ADV
R-0 (none)
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
T1-11, STD
R-0 (none)
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
T1-11, INT
R-0 (none)
R-1
R-2

R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
T1-11, ADV
R-0 (none)
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
2 x 6 Single Wood Stud: R-22 Batt
Lapped Wood, STD
R-0 (none)
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
Lapped Wood, INT
R-0 (none)
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
Lapped Wood, ADV
R-0 (none)
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
T1-11, STD
R-0 (none)
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
T1-11, INT
R-0 (none)
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
T1-11, ADV
R-0 (none)
R-1
R-2
R-3
R-4
R-5
R-6

R-7
R-8
R-9
R-10
R-11
R-12
2 x 8 Single Stud: R-25 Batt
Lapped Wood, STD
R-0 (none)
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
Lapped Wood, INT
R-0 (none)
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
Lapped Wood, ADV
R-0 (none)
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
T1-11, STD
R-0 (none)
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
T1-11, INT
R-0 (none)
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
T1-11, ADV
R-0 (none)
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
Other

WALL, BELOW GRADE CLASSES
No or Integral Insulation

CATEGORIES
2 ft Depth
3.5 ft Depth
7 ft Depth
Other

Interior Insulation

2 ft Depth
R-11
R-11 w/tb

R-19
R-19 w/tb
Other
3.5 ft Depth
R-11
R-11 w/tb
R-19
R-19 w/tb
Other
7 ft Depth
R-11
R-11 w/tb
R-19
R-19 w/tb
Other
Other

Exterior Insulation

2 ft Depth
R-10
R-12
Other
3.5 ft Depth
R-10
R-12
Other
7 ft Depth
R-10
R-12
Other
Other

FLOOR CLASSES	CATEGORIES
Over Vented Crawlspace or Unheated Basement	
	Post and Beam
	R-0 Floor + R-0 Perimeter
	R-0 Floor + R-11 Perimeter
	R-0 Floor + R-19 Perimeter
	R-0 Floor + R-30 Perimeter
	R-11 Floor + R-0 Perimeter
	R-11 Floor + R-11 Perimeter
	R-19 Floor + R-0 Perimeter
	R-19 Floor + R-11 Perimeter
	R-22 Floor + R-0 Perimeter
	R-22 Floor + R-11 Perimeter
	R-25 Floor + R-0 Perimeter
	R-25 Floor + R-11 Perimeter
	R-30 Floor + R-0 Perimeter
	R-30 Floor + R-11 Perimeter
	R-38 Floor + R-0 Perimeter
	R-38 Floor + R-11 Perimeter
	Joists
	R-0 Floor + R-0 Perimeter
	R-0 Floor + R-11 Perimeter
	R-0 Floor + R-19 Perimeter
	R-0 Floor + R-30 Perimeter
	R-11 Floor + R-0 Perimeter
	R-11 Floor + R-11 Perimeter
	R-19 Floor + R-0 Perimeter
	R-19 Floor + R-11 Perimeter
	R-22 Floor + R-0 Perimeter
	R-22 Floor + R-11 Perimeter
	R-25 Floor + R-0 Perimeter
	R-25 Floor + R-11 Perimeter
	R-30 Floor + R-0 Perimeter
	R-30 Floor + R-11 Perimeter
	R-38 Floor + R-0 Perimeter
	R-38 Floor + R-11 Perimeter
Over Heated Plenum Crawlspace	
	R-11
	R-19
	R-30
Exposed	
	Concrete
	R-11
	R-15
	R-19
	R-21
	R-25
	R-30
	R-38
	Wood Joist
	R-11
	R-15
	R-19
	R-21
	R-25
	R-30
	R-38
	Metal Joist
	R-11
	R-15
	R-19
	R-21
	R-25
	R-30
	R-38
Other	

SLAB CLASSES	CATEGORIES
Unheated	
	Uninsulated Slab
	2 ft Horizontal
	R-5

R-10
R-15
4 ft Horizontal
R-5
R-10
R-15
2 ft Vertical
R-5
R-10
R-15
4 ft Vertical
R-5
R-10
R-15
Fully Insulated Slab
R-10
Other

Heated

Uninsulated Slab
Fully Insulated Slab
R-5
R-10
R-15
R-5 Center
R-10
R-15
R-10 Center
R-15
3 ft Vertical
R-10
Other

WINDOW CLASSES	CATEGORIES
NFRC Certified	
Default	
	Any Frame
	Single
	Double
	1/2 inch Air, Fixed
	1/2 inch Air, Low-e=0.40, Fixed
	1/2 inch Air, Low-e 0.10, Fixed
	1/2 inch Argon, Low-e=0.10, Fixed
	Aluminum with Thermal Break
	Single
	Double
	1/2 inch Air, Fixed
	1/2 inch Air, Low-e=0.40, Fixed
	1/2 inch Air, Low-e 0.10, Fixed
	1/2 inch Argon, Low-e=0.10, Fixed
	Vinyl/Wood Frame
	Single
	Double
	1/2 inch Air, Fixed
	1/2 inch Air, Low-e=0.40, Fixed
	1/2 inch Air, Low-e 0.10, Fixed
	1/2 inch Argon, Low-e=0.10, Fixed

OPAQUE DOOR CLASSES	CATEGORIES
NFRC Certified	
Default	
	Uninsulated Metal
	Insulated Metal
	Wood

SKYLIGHT CLASSES	CATEGORIES
NFRC Certified	
Default	
	Sloped
	Any Frame
	Single
	Double
	1/2 inch Air, Fixed
	1/2 inch Air, Low-e=0.40, Fixed
	1/2 inch Air, Low-e 0.10, Fixed
	1/2 inch Argon, Low-e=0.10, Fixed
	Aluminum with Thermal Break
	Single
	Double
	1/2 inch Air, Fixed
	1/2 inch Air, Low-e=0.40, Fixed
	1/2 inch Air, Low-e 0.10, Fixed
	1/2 inch Argon, Low-e=0.10, Fixed
	Vinyl/Wood Frame
	Single
	Double
	1/2 inch Air, Fixed
	1/2 inch Air, Low-e=0.40, Fixed
	1/2 inch Air, Low-e 0.10, Fixed
	1/2 inch Argon, Low-e=0.10, Fixed
	Domed and Others
	Aluminum without Thermal Break
	Single Glazing, glass
	Single Glazing, acrylic/polycarb
	Double Glazing, air
	Double Glazing, argon
	Double Glazing, e=0.20, air
	Double Glazing, e=0.20, argon
	Double Glazing, e=0.20, air
	Double Glazing, e=0.10, argon
	Double Glazing, e=0.20, air
	Double Glazing, e=0.05, argon
	Triple Glazing, air
	Triple Glazing, argon

Triple Glazing, e=0.20, air
Triple Glazing, e=0.20, argon
Triple Glazing, e=0.20 on 2 surfaces, air
Triple Glazing, e=0.20 on 2 surfaces, argon
Triple Glazing, e=0.10 on 2 surfaces, air
Triple Glazing, e=0.10 on 2 surfaces, argon
Quadruple Glazing, e=0.10 on 2 surfaces, air
Quadruple Glazing, e=0.10 on 2 surfaces, argon
Quadruple Glazing, e=0.10 on 2 surfaces, krypton
Aluminum with Thermal Break
Single Glazing, glass
Single Glazing, acrylic/polycarb
Double Glazing, air
Double Glazing, argon
Double Glazing, e=0.20, air
Double Glazing, e=0.20, argon
Double Glazing, e=0.20, air
Double Glazing, e=0.10, argon
Double Glazing, e=0.20, air
Double Glazing, e=0.05, argon
Triple Glazing, air
Triple Glazing, argon
Triple Glazing, e=0.20, air
Triple Glazing, e=0.20, argon
Triple Glazing, e=0.20 on 2 surfaces, air
Triple Glazing, e=0.20 on 2 surfaces, argon
Triple Glazing, e=0.10 on 2 surfaces, air
Triple Glazing, e=0.10 on 2 surfaces, argon
Quadruple Glazing, e=0.10 on 2 surfaces, air
Quadruple Glazing, e=0.10 on 2 surfaces, argon
Quadruple Glazing, e=0.10 on 2 surfaces, krypton
Reinforced Vinyl/Aluminum-Clad Wood or Vinyl
Single Glazing, glass
Single Glazing, acrylic/polycarb
Double Glazing, air
Double Glazing, argon
Double Glazing, e=0.20, air
Double Glazing, e=0.20, argon
Double Glazing, e=0.20, air
Double Glazing, e=0.10, argon
Double Glazing, e=0.20, air
Double Glazing, e=0.05, argon
Triple Glazing, air
Triple Glazing, argon
Triple Glazing, e=0.20, air
Triple Glazing, e=0.20, argon
Triple Glazing, e=0.20 on 2 surfaces, air
Triple Glazing, e=0.20 on 2 surfaces, argon
Triple Glazing, e=0.10 on 2 surfaces, air
Triple Glazing, e=0.10 on 2 surfaces, argon
Quadruple Glazing, e=0.10 on 2 surfaces, air
Quadruple Glazing, e=0.10 on 2 surfaces, argon
Quadruple Glazing, e=0.10 on 2 surfaces, krypton
Wood or Vinyl-Clad Wood/Vinyl without Reinforcing
Single Glazing, glass
Single Glazing, acrylic/polycarb
Double Glazing, air
Double Glazing, argon
Double Glazing, e=0.20, air
Double Glazing, e=0.20, argon
Double Glazing, e=0.20, air
Double Glazing, e=0.10, argon
Double Glazing, e=0.20, air
Double Glazing, e=0.05, argon
Triple Glazing, air
Triple Glazing, argon
Triple Glazing, e=0.20, air
Triple Glazing, e=0.20, argon
Triple Glazing, e=0.20 on 2 surfaces, air
Triple Glazing, e=0.20 on 2 surfaces, argon
Triple Glazing, e=0.10 on 2 surfaces, air
Triple Glazing, e=0.10 on 2 surfaces, argon
Quadruple Glazing, e=0.10 on 2 surfaces, air
Quadruple Glazing, e=0.10 on 2 surfaces, argon
Quadruple Glazing, e=0.10 on 2 surfaces, krypton